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FINDING HOME AFTER FALLOUT
THE FUTURE OF FUKUSHIMA'S FORESTS

By

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Professional Paper

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Finding Home After Fallout: The Future of Fukushima's Forests

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This long-form journalistic piece is about radioactive forests in Yamakiya, Fukushima Prefecture, Japan, and how locals are dealing with it. Residents of Yamakiya were forced to evacuate their village in April 2011 following an explosion at the Fukushima Daiichi nuclear plant.

One Yamakiyan, Hidekatsu Ouchi, stepped into the role of community leader and is the focus of this story. He hopes Yamakiya can use the radiation, rather than condemning it. Ouchi's devotion to his community is connected to the Japanese concept of *furusato*, which refers to an individual's obligation and nostalgia for family, community and place. The story asserts that the forests surrounding the village are just as much *furusato* as the villages themselves, and it is this connection that drives locals like Ouchi to find ways to deal with the radiation that may not align with science.

Research and interviews throughout the story describe how radiation works and its effects on the landscape. Tim Mousseau, a scientist who has been studying radiation and biota in Fukushima and Chernobyl for nearly 20 years, said radiation slows both growth and decay of forest plants. It also causes genetic damage to forest inhabitants. Due to the nature of the radioactive element cesium-137, radiation cycles through forest biota like nutrients, becoming embedded in plants, creatures and detritus. It will take 300 years for the cesium to decay to pre-2011 levels.

The area's local nuclear emergency response manager, Katsushi Miyachi, reveals the government will conduct a test decontamination on a five-acre plot of forest in Yamakiya. Trees will be clear-cut on one half of the plot, and radioactive litter will be removed on both halves. Radiation will be monitored on both portions and in the surrounding areas to determine which method will be most effective. It is unclear how Japanese government will follow up with the results of this test, but Miyachi is determined to decontaminate each hometown mountain.

If the test decontamination results align with the science, Fukushima's forests may have to be entirely clear-cut to save the landscape, or the forest could suffer from hundreds of years of damaging exposure to radiation.

Steam filled the bathroom, fogging the window and condensing on the walls. The small exhaust fan overhead chugged to life. Hidekatsu Ouchi stepped into the hot bath. It was the first time he'd used it since 2011.

Hidekatsu settled into the tub, steaming hot water up to his chest. He rested his head on the tiled wall and closed his eyes in contentment.

"I've waited six years for this," he said.

Hidekatsu was born in 1948 in Yamakiya, Japan, a small village in Fukushima Prefecture about 25 miles inland from the Pacific and 150 miles north of Tokyo. Like his father, Hidekatsu farmed the land and foraged in the mountains, his life a part of the tapestry of Yamakiya.

The flow of seasons and community events create a comfortable rhythm of hard work and tradition in small, rural villages. Japanese call this deep connection to community identity *furusato*.

Furusato is deeper than the ties Americans feel to their hometowns. Over thousands of years, an individual's roots become inextricably tangled between family, community and place. They are nourished through generations of tradition to create *furusato*. It is incomprehensible in a country that is less than 300 years old. More than a feeling, *furusato* represents an obligation to a place and a community that is becoming difficult to find in modern Japan. Rural villages like Yamakiya represent the last remnants of these ideals.

Hidekatsu's *furusato* centered around his family and reflected a deep connection to the natural world.

Each village in rural Fukushima villages has a sacred, hometown mountain. Yamakiya's hometown mountain is next to Shimpukuji, the big temple in the village. In past years, local students would study the forest ecosystem on the mountain during the school year, and once a year, children would each plant a tree. Ten years later, they could return to see how tall their tree had grown — a lesson in how the past affects the future.

Hidekatsu has his own backyard mountain. Densely forested, a small wooden temple stands a few paces into the woods at its base. Two ancient stone graves rest behind the temple, weather-worn and covered with moss. Occasionally, dapples of sunlight break through the canopy to splay across the Japanese characters on the stones.

Towering cypress and pine trees darken a nearby creek, and impenetrable patches of bamboo stand alongside yellow and red oaks and maples. With every gust of wind, leaves rain down onto a thick, soft layer of litter on the forest floor.

In the spring, Hidekatsu would forage wild vegetables in the mountains. Many older residents in rural Fukushima prize mountain goods, such as *fuki* and *warabi*. Most

gatherers readily share these yields with friends and family, but jealously guard the location of their gathering places.

Hidekatsu harvested the real prize in the fall: large mushrooms called *kofuki-saru-no-koshikake*, or “powder-covered monkey’s bench.” They can grow on trees to more than three feet in diameter. Strapping a basket onto his back, Hidekatsu would venture into the woods with companions to hunt down these treasures. They were hard to find, but he knew where to look. The men used saws or hatchets to remove the leathery fungi from trees.

Through it all, Hidekatsu prayed to his ancestors in his home shrine and backyard temple. He worked with his neighbors. He cared for his family. Tradition and constancy nourished *furusato* in Yamakiya.

In 2011, everything changed.

On March 11, 2011, the Great Northeast Japan earthquake triggered a massive tsunami that swept inland, engulfing buildings and cars and carrying away entire neighborhoods. Nearly 16,000 people died, another 2,500 are still missing and presumed dead.

The earthquake knocked out the power at the Fukushima Daiichi nuclear power plant. The backup generators in the basement kicked on, ensuring that the cooling mechanisms surrounding the reacting fuel rods still functioned. If the fuel rods got too hot, they would melt through the containment vessels, potentially allowing radioactive particles to leak out.

Tsunmai waves as high as 45 feet overwhelmed the 19-foot seawall Tokyo Electric Power Company (TEPCO) officials had built to protect the plant from the sea. In constructing the plant, they had disregarded warnings of rare but disastrous waves.

The tsunami flooded the plant’s basement, knocking out the backup generators. Without the cooling mechanism, hydrogen began to build up in the containment vessels. Three days later, explosions at the plant ejected radioactive contaminants into the air and onto the wind.

It was snowing in Yamakiya on March 11, 2011. High above the coast and nearly 50 km from the plant, the villagers attended to the damage caused by the massive earthquake.

As the government announced increasingly broad and emphatic evacuation orders during the days following the tsunami, Hidekatsu and other residents gave little thought to fleeing.

Unknown to the villagers, the wind that brought the snow also carried a plume of radioactive cesium and iodine northwest of the plant. Irradiated raindrops, snowflakes and dust particles rose into the mountains.

More than a month after the accident, the Japanese government expanded the evacuation zone to include Yamakiya and other nearby villages. Evacuating cars lined up bumper-to-bumper on Highway 114, driving northwest toward safety in Kawamata and Fukushima City.

Hidekatsu found safety, but not home, in temporary government housing. Other Yamakiyans stayed with relatives or used government compensation payments to build new houses. Whether they knew it or not, the contamination was settling into the roots of Yamakiya, inextricably becoming entrenched in the land and tangled in the lives of the evacuees.

As of September 2017, only 122 of 350 Yamakiya households had returned to the village, and fewer than 90 more said they hoped to return soon. Officials say that those who did not return by spring of 2018 are unlikely to ever move back.

In some areas of Fukushima Prefecture, levels of radiation are so high that residents will never be able to return. With ties to their ancestral homes cut, more than 80 suicides occurred in the five years following the disaster. Countless people continue to suffer from ongoing depression and anxiety.

The government has decontaminated the living areas of Yamakiya and declared the village safe for habitation, but the mountainous forests are considered nearly impossible to clean. Children no longer venture into the forest behind Shimpukuji to plant trees or study the ecosystem. The government has forbidden foragers from gathering wild vegetables and mushrooms.

Many former residents of Yamakiya don't want to expose themselves or their families to the risk of what's lurking in the forests and creeping into the valley with every rainfall and gust of wind. The contamination moves through the ecosystem, cycling through plants and animals alike.

Villages identify 108 contaminated hometown mountains in Fukushima Prefecture, and few of them feel like *furusato* anymore.

But Hidekatsu hasn't given up on Yamakiya, its mountains or its forests. He was the first resident to move back when the evacuation order was lifted in March 2017, just over six years after the accident. He came home, took a bath and emerged with a sense of purpose.

"My friends feel like they don't have a home to come home to," Hidekatsu said. "Whatever I have left in me, my life, it's my task, my life work, that I'm going to make Yamakiya a town that everyone can be proud of and come back to."

Hidekatsu is determined to find the silver lining under — or even within — the layer of radiation that coats the mountains and forests.

But unlike snow that sits atop the earth, radioactive particles are not sedentary.

As nutrients cycle through the forest, radioactivity hitches a ride, infusing the landscape. Removing it entirely would save the land from hundreds of years of damaging exposure to radiation. But it would also create an apocalyptic landscape, devoid of the physical characteristics that made it *furusato* in the first place.

Nevertheless, some Yamakiyans are determined to reclaim their *furusato*, even if that means adapting it to a radically-altered, post-radiation landscape.

Home, again

Some people are returning to Yamakiya, despite the constant threat of radiation in the forests.

Hidekatsu volunteers at the public safety office across the street from his home. As part of the recovery effort, he helped build a new multipurpose building on the plot of land next to the office. Visitors wander through an information suite and can visit a restaurant, grocery store, food testing station and public restrooms.

The visitor's suite features informational pamphlets, and a public officer is available to answer questions. Photos of the local drum group dot the partition that designates space for a specialist who can test food samples from locals for radiation.

The grocery store opened in July 2017 and sells intentionally cheap goods to encourage locals and passersby to shop there. One of the products sold in the grocery store is Hidekatsu's own noodle flour, made from the wheat he grows on the side of his backyard mountain.

He decontaminated the wheat field himself with a backhoe. At the base of Hidekatsu's mountain, he grows blueberries for jam in his government-decontaminated backyard.

But decontamination on a larger scale is painstaking work. Workers must remove plant matter and scrape two inches of soil and rocks off the ground. They wash the walls and roofs of homes. Contaminated materials are collected in huge, black one-ton bags. Cleaned areas must meet ambient radiation standards before residents can return.

While most areas in town meet that threshold, radiation levels in the contaminated forests remain high, and government officials warn residents against spending too much time in the woods. Forests comprise more than 70 percent of Fukushima, and the Japanese national government argues that it would be incredibly expensive, complex and time-consuming to decontaminate them.

But radiation moves through a forest in complex cycles that concentrate contamination over time, making decontamination seem imperative to restoring community health and confidence. If nothing is done, the damage will worsen over time.

Radioactive particles travel through plants and animals the same way nutrients do. But instead of providing nourishment, they release destructive energy that slowly damages organisms at an atomic — and genetic — level.

Particles that arrived on the wind land on leaves and soil, where they are taken up by trees, expressed in the leaves and returned to the soil each autumn. There, they change the soil biome, inhibiting the natural flow of decay and growth, creating a deeper layer of contamination.

The particles can ride on gusts of wind or in water runoff into the valley, threatening to recontaminate areas that have already been cleaned. Removing these contaminants from the landscape requires drastic measures, but leaving them in the forests could perpetuate an almost endless cycle of recontamination.

With such a daunting threat right in the backyard, Hidekatsu is looking for other ways to address the radiation.

Since returning to Yamakiya, Hidekatsu has opened his home to visitors from all over Japan and the world. He loves exchanging stories with his guests, often recounting his own travels in Mongolia where he developed a fascination with rock salt. Rough, rosy chunks of the mineral line the shelves inside his refrigerator doors and clutter a dry fish tank in the entry of his home. He speaks often of the healing components of nature and simple foods.

Hidekatsu finds hope in places that have high levels of natural radiation like Ramsar, Iran, and Tamagawa Onsen, one of Japan's many natural hot springs that is frequently used for bathing. He wonders if Yamakiya could forge the unnatural radiation into something fruitful.

“There must be something that the radiation is good for,” Hidekatsu said. “Rather than saying it's dangerous, we need to think about how it can be used.”

There are essentially four popular theories when it comes to the effects of radiation, all of which hold that exposure to high doses of radiation is harmful. However, hormesis, the most contested and least scientifically-supported of these theories, suggests that very low doses may result in positive effects.

For centuries, traditional Japanese medicine has advocated visits to hot springs that contain low levels of radiation, high acidity and a variety of naturally-occurring chemicals. Medical tourism has flourished around some of these springs, which attract thousands of ill patrons every year.

Hidekatsu points to the months-long waiting list of visitors wishing to spend time at Tamagawa Onsen as treatment for their terminal illnesses. The natural hot spring is unique among Japanese onsens, as patrons believe a rare, radioactive stone at the site can prevent and treat cancer.

Maybe Yamakiya could become a similar destination, Hidekatsu said. Anything to bring people back into the village and breathe life back into his *furusato*.

One of Hidekatsu's frequent foreign visitors disagrees.

A strangely apocalyptic onsen and difficult dreams for the future

Tim Mousseau is a biologist and global radiation expert. When the Fukushima Daiichi nuclear power plant exploded in 2011, he knew from his studies in Chernobyl that it was important to initiate a long-term study on the Japanese wildlife in affected areas as soon as possible.

Mousseau and a team of researchers rented Hidekatsu's home for short periods during the evacuation to conduct studies in the most irradiated zones. After the evacuation order in Yamakiya ended, Mousseau continued to rent a room in Hidekatsu's home for research trips into nearby evacuated zones. During these visits, the two discuss science, philosophy and world politics.

Mousseau has studied the long-term effects of low-level radiation for nearly 20 years. While his research focuses on wildlife and plants, his findings may have direct implications for Hidekatsu and his dream of a livable Yamakiya.

Hidekatsu's willingness to embrace the healing effects of radiation worries Mousseau.

"Just because it's low radiation doesn't mean it's harmless," Mousseau said, out of Hidekatsu's earshot. It worries Mousseau that people misunderstand — or misrepresent — the difference between naturally occurring radiation and contaminants released from a nuclear accident, and the difference between high-dose exposure and very low-dose exposure. Some nuclear energy advocates, government officials and plant owners occasionally try to make the case for hormesis, he said.

"The problem is that a lot of these people try to suggest that not only is there not a risk, but there's some benefit," Mousseau said. "I think that's very irresponsible. It gets people like Hidekatsu thinking that it could get Yamakiya some kind of strangely apocalyptic onsen."

The amount of contamination isn't the only concern in the affected areas; the kind of radiation emitted can have a big impact on the health of the environment. The explosion at Daiichi released ionizing radiation, which has lots of energy and can damage materials and tissues on a molecular level as unstable isotopes decay.

Ionizing radiation comes in three forms.

As unstable isotopes decay, they release energy in the form of errant atomic particles — alpha, beta and gamma particles. Alpha radiation has the least amount of energy, so a

protective layer of clothing can typically block them. Beta radiation is stronger and can travel farther, but cannot penetrate solid materials.

Gamma radiation is the most dangerous form of radiation. It has no mass and can pass through most materials, penetrating tissue and damaging cells in the body. In high doses, it can cause burns on contact and increase the chances of developing cancer. All three types of radiation can be very harmful if inhaled or ingested.

It is difficult to clearly tie low levels of radiation to the development of diseases because humans are exposed to so many largely innocuous sources of radiation in daily life. That means Mousseau has his work cut out for him. Not only must he focus on collecting iron-clad data, but he must also navigate government restrictions to visit the affected areas in the first place.

In the no-go zone

Visitors entering the officially dubbed “difficult-to-return-to” zones, less than 20 minutes’ drive from Yamakiya, must obtain special permission from the local government. Journalists enter the zone to document the empty villages and destructive herds of wild boar. Workers trim weeds from roadsides, and homeowners maintain properties they can no longer call home. These areas were once *furusato*, the hometown people longed to return to. Now former residents must ask the government if they can visit for even a few hours at a time.

What visitors won’t see in the no-go zones are Japanese government-sponsored research teams. Mousseau said most of the teams he knows of in the zone are international.

It’s not because the Japanese government doesn’t value good research, Mousseau said. He feels like it is because they might be afraid of what they find. The Japanese government has long been accused of being too close to the nuclear industry and TEPCO. Unfavorable findings could jeopardize the country’s future use of nuclear energy.

Mousseau says he stays out of politics. Instead, he focuses on furthering robust science that politicians around the world can use to inform policy and decisions. He goes to the no-go zone to do this work because no one else will.

Highways 114 and 399 pass through the zone and were closed to the public for years following the accident. Now that they’re open, Mousseau must make appointments with representatives at different gates to enter or exit. He shows his passport and permission slip, and they let him through when the documents match. Even on the hottest days of summer, gate workers wear a blue, one-piece uniform, white gloves and a face mask to protect them from radiation exposure. If a routine check reveals these clothes have become highly irradiated, they will be incinerated.

The Japanese government set the national radiation exposure safety limit at 0.23 microsieverts (μSv) per hour. A typical American is exposed to 1,000 μSv in a year. The most contaminated areas Mousseau visits in Fukushima can reach levels of 64 μSv per

hour or higher. At one time, the hottest area in the zone measured more than 300 μSv per hour.

In America, the yearly legal exposure limit is 50,000 μSv . Japan set its legal limit at a more conservative 20,000 μSv per year. If Mousseau stayed in the hottest zone he visits in Fukushima, he would exceed his Japanese yearly limit in less than two weeks and his American limit in 33 days.

Mousseau has been studying radiation and its effect on living things since 1999. Much of his work has centered on birds, insects and mammals in Chernobyl. Fukushima represents an opportunity to study a nuclear disaster from its onset and confirm previous findings in Russia.

Fukushima's forests, which suffer from the same contamination that lurks in Hidekatsu's contaminated backyard mountain, could fill a gap in existing knowledge about the connection between low-dose, long-term radiation exposure and multigenerational genetic defects.

The March 11, 2011, accident released notable amounts of four radioactive isotopes: iodine, xenon and two isotopes of cesium. While still dangerous, three of these isotopes will decay to relatively safe levels within 20 years of the accident.

The isotope cesium-137, on the other hand, will take 300 years to decay to pre-3.11 levels of radiation. Officials are especially concerned about cesium-137 because it emits beta and gamma radiation, two of the more dangerous types.

The no-go zones aren't the only places with dangerous amounts of cesium-137 — the forests of Yamakiya still contain abnormally high levels of radiation. Hidekatsu's family shrine is nestled in a forest emitting unhealthy levels of beta and gamma radiation.

In the abandoned areas of Chernobyl and Fukushima, Mousseau and other researchers are studying plants and animals that aren't exposed to everyday radiation sources like cell phones or air travel. Instead, they're living with nuclear contamination, a more significant and constant source of radiation. While this creates a constant for scientific research, it also means dangerous side effects for the inhabitants of the forest.

Radiation can kill outright in large doses, but lower doses can cause harmful mutations that take several generations to manifest in a population. Creatures with shorter lifespans and high reproduction rates, like insects and birds, are often the first observable victims of mutation accumulation. Mousseau has already observed declining numbers of Fukushima insect and bird populations.

If consequences of radiation exposure have already become apparent in the seven years following the disaster, 300 years of beta and gamma radiation cycling through the forest's ecosystem could cause irreparable genetic harm to plant and animal species alike.

International attention on the Fukushima accident often focuses on apocalyptic abandoned villages and halted lives. Destructive herds of radioactive boar make headlines, and a rare bear sighting in Fukushima made the nightly news. But for residents, the real story is how radiation is changing the forests, changing *furusato* and, in some ways, becoming part of it.

Gone but not forgotten

Tomioka Highway winds northwest from Yamakiya, through Kawamata Town, and continues its labyrinthine path through the mountains to Fukushima City. Just before it leaves Kawamata Town, it passes a brand-new house on the right side of the road. This is the house of Kunihiro Ouchi.

Before March 2011, Kunihiro farmed tomatoes and rice in Yamakiya near his friend Hidekatsu. Yamakiya is unlike anywhere else, he said. The conditions are just right for farming, and the valley produced tasty vegetables that Yamakiyans believe are better than vegetables grown anywhere else. Kunihiro now grows vegetables in Kawamata Town, but they never taste as good as vegetables from Yamakiya did.

If he was 15 years younger, Kunihiro said he would have moved back last year and picked up the farm where he left off. But he got older, and he built a house in Kawamata Town three years ago. Even if Kunihiro went back now, things wouldn't be the same.

"It's been six years, and it's possible to go back and do that again," Kunihiro said. "But a lot of people are prejudiced as far as growing things. I think they don't want to consume them."

Many people around Japan fear eating Fukushima-grown crops, though they don't hold the same fears about non-food crops like flowers.

After the nuclear disaster, national and international governments banned the import of Fukushima food and fish. Farmers lost their way of life overnight, even if their land hadn't been contaminated.

The accident has borne some strange fruit for local farmers.

Even without crops, Kunihiro's farmland is still earning money. Like many residents in affected areas, he has rented some of his land to the government for short-term storage of the one-ton black bags, full of the removed soil and other radioactive waste from decontaminated fields and villages.

"Short-term storage" was supposed to be three years, but that was seven years ago. Local officials fear the bags could be there until the government finds a permanent storage site, perhaps 10 years from now or longer. Residents fear the bags will begin to deteriorate, releasing literal tons of radiation back onto their fields. Some of the bags are already beginning to split.

Kunihiro thinks the bags are bad for the land and bad for the people.

“Those mountains of black bags really get to you,” Kunihiro said. “I asked the government not to place the black bags on top of rice fields because it’s an eyesore.”

But rice fields are flat, and thousands of acres in Fukushima are covered with millions of black bags, with no definite schedule for removal.

With each new decontamination project, more bags are filled with contaminants and placed in temporary storage. As the piles grew higher, the government began constructing white fences around the laden fields to obscure the bags from view. But everyone knows what’s behind the ubiquitous white fences.

Beneath your feet and in the soil

For residents, it’s hard to see the forest for the conspicuous black bags. For scientists like Mousseau, it’s hard to see anything else.

Radiation is especially challenging in forests. Contamination cycles through plants and animals, altering the pulse of a once-efficient and predictable system. Cesium-137 is moving through the ecosystem and the trees themselves.

Radiation slows the rate of both growth and decay. When trees and other plants pull water from the soil, radioactive particles tag along. The water evaporates as dew out of the leaves, and the radioactivity becomes concentrated. In trying to remove the contaminants from the soil, the trees collect it all in one place.

When the leaves fall in the autumn, the radiation falls back to the earth within them.

“They’re bringing that radioactivity that had been in the deeper soil back to the surface,” Mousseau said. “So, the surface layer, which is irradiating gamma radiation, isn’t dropping as quick as you’d expect based on natural decay of the cesium because it keeps getting concentrated on the surface layer.”

Once on the ground again, the radiation disrupts microbial activity that decomposes dead organic matter. This invisible contamination depresses the unseen processes in the soil that cycle nutrients and feed the forest.

“That’s the big story,” Mousseau said. “We’ve understated the importance often, but it’s so incredibly important that it’s very clear that microbial activity is reduced under conditions of higher radioactivity.”

The contaminated forest cycles have broad implications for everything that lives in or near the forest. Fewer nutrients decrease plant growth, leaving less food for foraging wildlife. Deeper litter increases the risk of fire, which creates a risk of renewed wind-born radioactive contamination in the region and beyond.

Mousseau saw these effects in Chernobyl. Higher radiation levels in the soil reduced decomposition rates by up to 50 percent. Fallen trees in the Red Forest that should have decayed within a few years remained solid on the forest floor a decade later. When industrial fire broke out in Chernobyl in 2015, it spread quickly through the accumulated leaf litter on the forest floor. Burning leaves released collected radiation, sharply raising measurements at the site. Heat from the fire acted like a volcanic eruption, sending radioactive particles into the atmosphere and across the globe.

It's hard to predict how a forest fire might play out in Japan's irradiated forests. The forest is wetter and doesn't seem to be suffering from the drying effects of climate change like Europe's forests are. But a deep layer of leaves, heavy with radiation, feeds trees and disperses particles down the mountainside with each heavy rain. Decontaminated valleys are in danger of becoming contaminated once again.

How to decontaminate a forest

The threat of recontamination is what worries Katsushi Miyachi.

Miyachi, the manager of the area's nuclear emergency response team, is willing to destroy swaths of mountain forests now, if that might bring residents back and save *furusato* for future generations. The only way to fully remove the radiation is to remove everything on the landscape that has radiation in it — trees, leaves, soil. A decontaminated, livable forest would appear apocalyptic compared to the pristine, but potentially deadly forests that still stand today.

For the past five years, Miyachi has pestered the national government, demanding it conduct a test decontamination of a local mountain. He thinks decontaminating hometown mountains and making them safer will encourage residents to return.

“What I cannot endure is when I see their hearts are broken,” he said, thinking of the displaced residents. “I would like to help them return.”

After the 2011 disaster, Miyachi was sent from the Aichi Prefecture, 300 miles to the southwest, to help with the cleanup. He went home to Nagoya every two months to see his wife, but his heart stayed in the north.

Back home, his wife could see he was tired but fulfilled in a way she had not seen before. After three years of commuting for his work, Miyachi, 55 at the time, quit his job. He took the job managing the nuclear emergency response efforts in Fukushima. Hounding the national government to do more for the sacred mountains became his purpose.

“I think decontamination helps us get our heart back,” Miyachi said.

Miyachi finally convinced the Ministry of the Environment to do a model test on just five acres in the forest behind Shimpukuji. The test is a joint project between various national and prefectural agencies. The Ministry of Agriculture, Forestry, and Fisheries cleared

paths and removed excess brush in the autumn of 2017 to help prepare the area for the decontamination to come.

The Ministry of the Environment will oversee the decontamination. Workers will clear-cut the trees on one half of the plot and leave trees on the other half. They will scrape the land of soil and contaminated litter on both portions, and gather the material in bags to be stored elsewhere. The Fukushima Prefecture will compare radiation levels on the two portions and surrounding areas, and will take more measurements at regular intervals throughout the process.

The completion of the test decontamination is scheduled for September 2019, when the three authorities will review and wrap up the test.

Miyachi hopes the decontamination will lead to broader projects that will make it safe for Yamakiyans like Hidekatsu and other rural residents to once again venture into the forest to collect wild vegetables and mushrooms.

Before the disaster, foragers collected forest goods both for themselves and to distribute among the community. Over time, rural Fukushima villages built a food culture unique to the region and some became globally known for high-quality mushrooms.

Mushrooms, however, absorb cesium from the soil and store it, releasing the radioactive elements back into the air via spore bursts. Japan set a national limit on the amount of cesium that can be in crops and gathered food like mushrooms. One mushroom sample collected from a nearby affected village contained 90 times the acceptable limit.

For Miyachi, the loss of these “fruits of the mountain” is a loss of bonds between neighbors. Urban Japan doesn’t see the significance in gathering wild goods when they can buy mushrooms at the store, but Miyachi said it’s more about the connection between people than it is about food.

“The communication tool is gone between the giver and the receiver,” Miyachi said. “That is, for us, of utmost importance.”

Many older residents of Fukushima continue to forage out of tradition. Despite bans on eating forest goods, some still consume what they gather. Younger people, who were already gathering less than their parents, are forbidden from gathering entirely. Hidekatsu’s generation fears the centuries-old tradition of foraging mountain plants may be lost before the forests are decontaminated and have a chance to regrow.

Wide-scale decontamination of Fukushima’s forests would take decades, and it all hinges on whether the test is successful and Miyachi manages to convince the national government to continue the project.

Like many people, Miyachi doesn't trust the national government when it comes to information about the nuclear disaster or current levels of radiation. National representatives have close ties to nuclear power companies.

Miyachi suspects his test decontamination might all be for show.

"The national government thinks this is just a performance," Miyachi said.

He feels the government is not giving Fukushima the attention it still deserves seven years after the accident. Miyachi said the government wants to wrap up Fukushima and focus on the 2020 Tokyo Olympics.

But he pestered the government for five years until they approved the test, and he won't give up when the test is completed.

"I'm threatening them to say, 'After the model test is done, do the rest of the mountains,'" he said.

When the rest of the mountains are cleaned, most of the radiation will be gone. But the forests will be gone, too. If it takes 300 years for cesium-137 to decay to safe levels, it could take just as long to regenerate the mature, diverse ecosystem on the land today, from the soil to the trees.

Adapting *furusato*

As radiation moves through an ecosystem, it affects everything. Research in Chernobyl indicates that forest creatures are developing cataracts and tumors, becoming less fertile and, when they are able to reproduce, passing genetic mutations on to their young. Two decades after the disaster, some species of birds have disappeared from the area entirely.

Without removal, the radiation in Fukushima will decay to safe levels in 300 years, but the genetic structure of the forest will be forever changed.

Miyachi's plan to physically remove the irradiated material is bold and optimistic. Destroy the forest now to save it for future generations. Remove the radiation so people can move back to their *furusato*, their hometowns, without fear of passing genetic defects on to their children.

But if the irradiated forests are cut down, will the area's *furusato* be destroyed?

Without fertile ground, where will the trees and *furusato* root?

Hidekatsu isn't sure.

On one hand, he is grateful for the efforts to clean the forests. On the other hand, he regrets the loss of the forest's fertility in the process.

“This is where I feel the national government is making a mistake,” Hidekatsu said. “If they cut the tree and leave it there, it becomes fertilizer, but they are packing it away and removing it.”

It will take 500 years for the forests to reproduce the rich, black topsoil that will be removed during the test decontamination, Hidekatsu said.

But while the forests are close to his heart, Hidekatsu’s *furusato* is more than the trees and mushrooms.

Furusato is the local drum group, Yamakiya Taiko, that still practices in the community center for their national and international performances. At rehearsals, Hidekatsu sits or stands with his arms crossed and head high, listening to the furious beat of their *furusato* hymn.

It is the flower-farmer couple down the road from Hidekatsu’s house, whose business is booming because consumers don’t fear radiation in flowers. They have not yet moved back to Yamakiya but spend every weekend in the Yamakiya home they built during the evacuation with the wood from two 200-year-old trees in their backyard.

It’s the retired poultry farmers at the edge of the no-go zone, who gather and eat wild vegetables to preserve the tradition. They don’t share mushrooms with their children or grandchildren anymore, but they’re not worried about the consequences of radiation at their age.

Furusato is Hidekatsu himself.

When everything crumbled in the wake of 3.11’s triple disaster, Hidekatsu found renewed vigor and pride in his hometown. With the compensation payments from the government, he helped rebuild his village, drawing in new visitors and reinvigorating the area. He is remodeling his own home and buildings, to better host foreigners who come to visit, study and learn.

In nature, creatures who cannot adapt must move or perish.

In this new, radioactive landscape, Hidekatsu transformed from a retired man to a community leader, quietly opposing the national government and representing his village in stories around the world. He has embraced radiation as another quirk of Yamakiya’s *furusato*. Those who cannot do so are finding new places to live.

In 10 years, Yamakiya may no longer look or feel like the *furusato* it once was for Hidekatsu and his neighbors. The faces will have changed, and the forests may be gone or genetically altered or both. Children of evacuees won’t call it home anymore, and foragers may no longer wander the mountains in search of *fuki* or *warabi*.

But Yamakiya will become the location of a first-of-its-kind test decontamination that could inform nuclear reclamation around the globe. The new multipurpose building already draws in visitors, and entrepreneurs are setting up shop in Yamakiya, looking for business opportunities in disaster cleanup.

Yamakiya's *furusato* may never be the same. But, like a tree in the forest that bends to reach the sunlight, it can adapt. And with the right fertilizer, it can grow.

Hidekatsu is one Yamakiyan looking for that sunlight.

"I love Yamakiya so much," he said. "People who have returned feel this place is better than anywhere else... I think we have to get along with radiation."

Before the accident, Hidekatsu would transform an unused rice paddy — *tanbo* — on the lot next door into an ice skating rink for the local skating club. Since the evacuation order was lifted, he's resumed the tradition, drawing hundreds of children back into Yamakiya.

To make ice, Hidekatsu sprays water from a hose onto the rice paddy, standing in frigid mountain air during late hours of the night.

Sometimes it snows, leaving a soft layer on top of the ice. Hidekatsu gets in his tractor and scrapes it off.